AMENDMENTS TO THE DRAWINGS

The attached sheet(s) of drawings includes changes to Figs 1-3. Formal drawings for all figures are attached.

Attachment: 14 replacement sheets

REMARKS

Claim 1 has been amended. Claims 1-14 remain in the application. Reexamination and reconsideration of the application, as amended, are respectfully requested.

Claim Rejections - §112

The Examiner has objected to claims 1 – 12 as lacking enablement. The Examiner suggests that the specification is not enabling as to how the skilled person would make the area of a second sub-pixel not substantially a multiple of the area of the first sub-pixel. It is respectfully submitted, however, that a skilled person in the field of liquid crystal design and manufacture would be well aware of how to produce a device with a particular ratio of sub-pixel areas. This could be achieved in various ways.

It is a known basic feature of liquid crystal displays that a liquid crystal material is located between two cell walls. Electrodes are formed on both cell walls to provide separately electrical addressable areas. In a passive matrix device one cell wall carries row electrodes and the other cell wall carries column electrodes. The area of overlap of the electrodes defines the area of the addressable area. It is therefore clear and very well understood in the art that different sized addressable areas (or sub-pixels) can be formed by use of different widths of electrodes. This is used in the well known principle of spatial dither – as indicated in the references cited by the Examiner. An example of how this may be applied to an embodiment of the present invention is shown in Figure 13. In this example the pixel comprises two addressable areas (shown on the left). Each shares a common row electrode which is 200μm wide. The smaller area is formed through overlap with a column electrode 57μm wide whereas the larger area is formed from overlap with a column electrode 133μm wide. This gives an area ratio of 3:7. Therefore the specification gives a clear indication to a skilled person of how separate addressable areas can be formed with the area of one addressable region not being a multiple of the smaller region.

The Examiner has also suggested that the requirement that the first and second addressable sub-pixels have the same number of selectable transmission/reflection levels is not enabled by the specification. This basis for rejecting the claims is respectfully traversed. The

requirement simply means that each sub-pixel can be set to a number of grey levels and that the number of grey levels is the same for both the first and second sub-pixels. As mentioned throughout the specification, a sub-pixel can be subdivided into different parts having different switching thresholds (see, for instance, page 20, lines 13 to 29). An example of this is shown in the context of the present invention in Figure 13, again where each of the two sub-pixels shown have three different grating areas each giving rise to bistability but which latch at different thresholds. Thus, in this example, each sub-pixel has 4 transmission or reflection levels (all white, 2/3 white, 1/3 white or all black) which can be selected by writing the appropriate voltage pulse to the sub-pixel. It is therefore respectfully submitted that enabling support for this requirement is provided in the specification, and that the specification and claims are in full compliance with the requirements of 35 U.S.C. §112.

Drawings

The Examiner has required formal drawings to be produced. Accordingly, applicants propose that Formal Drawings be made as indicated beginning on page 7 and included in the attached replacement sheets. These drawings include the legend "Prior Art" for Figures 1 – 3 to address the Examiner's objection in relation thereto.

The Examiner has also objected that the drawings do not show that the area of a second sub pixel is not substantially a multiple of the area of a first sub-pixel. It is respectfully submitted, however, that this is shown in Figure 13. With respect to claim 6 it is submitted that Figure 13 shows that the area of each sub-pixel is not a multiple of the next smallest sub-pixel (albeit only two sub-pixels are shown).

The Examiner has also suggested that the addressing means of claim 1 is not shown. Accordingly, to more clearly conform the written description and Figures to the recitation of claim 1, applicants have added a box to more clearly indicate the addressing means to Figure 2. No new matter has been added. Applicants have further amended the text to refer to the addressing means by adding the following sentence at page 15, line 4: "Addressing means 14 addresses separately addressable areas of the device to switch the liquid crystal material between the two states." No new matter has been added.

Claim Rejections - §103

The Examiner has rejected claim 1 as being obvious over Hughes et al. (US 5,905,482) in view of Bock et al. (US 6,417,868). The Examiner argues that Hughes teaches all the elements of claim 1 apart from that the area of the second sub-pixel is not substantially a multiple of the area of the first sub-pixel.

This rejection is respectfully traversed with respect to the claims, as amended.

Claim 1 of the present application relates to a liquid crystal device having spatial dither, i.e. each pixel comprises more than one sub-pixel. The areas of the sub-pixels are different but, unlike conventional spatial dither, the area of a larger sub-pixel is not a multiple of the area of a smaller sub-pixel.

Claim 1 also requires that each sub-pixel is capable of being switched between more than two reflection or transmission levels. The claim language states that the sub-pixels have the same number of selectable transmission/reflection levels and that the addressing means is capable of selectively addressing the sub-pixels to select any one of more than two transmission levels. Claim 1 has been amended to further clarify this aspect of the invention.

Figure 11 illustrates an example of conventional spatial dither in a bistable liquid crystal device. The left hand side of Figure 11 shows two sub pixels. Each sub-pixel is divided into three different areas, each of which has a different latching characteristic. The two states to which the liquid crystal material can be latched may be referred to as black (non-transmissive) and white (transmissive). By application of an appropriate voltage each sub pixel can be set to be all black, one third black, two thirds black or all white. The area of the larger sub-pixel is chosen to be a multiple of the area of the smaller sub-pixel in the ratio 1:4. This then allows the pixel to display 16 different grey levels as illustrated on the right hand side of the Figure.

Figure 13 illustrates an example of the present invention. Again in this example there are two sub-pixels, each having three equal areas of different latching characteristic. However in this embodiment of the present invention the ratio of the areas of the smaller to the larger sub-

pixels is 3:7, i.e. the larger area is not a multiple of the smaller area. This again allows 16 different grey levels as shown on the right.

Hughes does mention use of spatial dither and does teach use of differently sized sub-pixels. The Examiner acknowledges that Hughes fails to teach that the area of a second sub-pixel is NOT a multiple of the area of a first, smaller sub-pixel. Hughes specifically teaches a ratio of 1:2 (col. 11, lines 34 – 36).

It is also noted that Hughes fails to teach that each sub-pixel has more than two selectable levels of transmission/reflection. Each sub-pixel in Hughes has purely two transmission levels, i.e. the sub pixel is bistable and all arranged to latch at the same voltage, thus each sub-pixel can be only black or white.

The Examiner states that Bock teaches a device having a plurality of sub-pixels whose area is not substantially a multiple of the other sub-pixels.

Bock does indeed show a device which has areas formed by the intersection of row and column electrodes where the area of one intersection is not a multiple of the area of a smaller intersection. With regard to Figure 3 of Bock and column 4, lines 20 – 31, the total pixel 10 is made up by the intersection of three column electrodes 51, 52, 53 and three row electrodes 61, 62, 63 making nine separate areas of intersection. The widths of the columns are arranged in the ratio 2:1:3 and the widths of the rows are in the ratio 1.5:1:2.5.

This means that the area of smallest overlap (area 45 – middle column, middle row) compared to the area of the next smallest overlap (area 42, middle column, top row) gives a ratio of (1x1):(1.5x1) or 1:1.5. In other words area 42 is not a multiple of the area of area 45.

However, it should be noted that the sub-pixels as claimed in claim 1 are separately addressable sub-pixels. In the device described in Bock area 45 does not represent a separately addressable area and so does not constitute a sub-pixel as claimed in claim 1. Bock makes it clear that the device described therein can be operated in two separate modes. In a first mode columns 51 and 52 are driven together, as are rows 61 and 62 – see column 4, lines 23 – 31). Thus any voltage applied to area 45 by application of appropriate voltages to the row and

column electrodes is also inevitably applied to areas 41, 42, and 44. Thus in this arrangement areas 41, 42, 44 and 45 are not separately addressable but are only addressable together and collectively form a single sub-pixel. Other sub pixels are formed by the intersection of column 53 with rows 61 and 62 (i.e. areas 43 and 46 together), the intersection of row 63 with columns 51 and 52 (i.e. areas 47 and 48 together) and the intersection of column 53 with row 63 (i.e. area 49). As explained at column 4, lines 23 – 31 this results in four sub-pixels of equal area (the width of rows 51 and 52 together compared to the width of row 53 alone give a ratio of 2+1:3 or 3:3 or 1:1 and the width of columns 61 and 62 together compared to the width of column 53 alone gives a ratio of 1.5+1:2.5 or 2.5:2.5 or 1:1).

In an alternative arrangement the device is driven so that column 51 is driven on its own and columns 52 and 53 are driven together. Likewise row 62 is driven on its own and rows 61 and 63 are driven together. In this arrangement any voltage applied to area 45 is also applied to areas 46. Thus areas 45 and 46 form a separately addressable area or sub-pixel. Other sub pixels are formed by area 44 alone, areas 41 and 47 together and areas 42, 43, 48 and 49 together.

The smallest sub-pixel is therefore area 44. The next smallest is areas 45 and 46 together. The ratio of the areas can be determined as (1.0 x 2) : (1.0 x (1 + 3)) or 2:4 or 1:2. The ratio of the other sub-pixels can be similarly determined and it can be seen that the four sub-pixels have the area ratios of 1:2:4:8.

Therefore although Bock does teach areas of overlap of electrodes which are not multiples, these areas of overlap are not arranged to be separately addressable. Switches 86 and 88 ensure that either rows 61 and 62 are driven together or rows 61 and 63 are driven together. Likewise column 52 has to be driven with column 51 or column 53 and can not be separately addressed.

Bock deliberately teaches that the sub-pixels formed from these combinations have areas which are equal in one configuration or multiples of the smallest sub-pixel area in the other configuration. Thus Bock teaches a device wherein the resolution of the display can be changed from a high resolution mode to a low resolution mode. In the low resolution mode the device has conventional spatial dither with integer weightings in spatial area. In high resolution mode

there is no spatial dither but simply a series of equally sized pixels of smaller size (column 4, lines 53 – 62).

Therefore it is respectfully submitted that Bock does not disclose or suggest a device having a plurality of separately addressable sub-pixels of different area wherein the area of a second sub-pixel is not a multiple of a second, smaller sub-pixel and if anything reinforces the conventional teaching that for spatial dither one needs the larger sub-pixels to be an integer multiple of the smaller sub-pixel.

Bock contains no teaching or suggestion of a device where the sub-pixels exhibit more than two transmission/reflection levels. The sub-pixels in Bock are purely on or off, i.e. there are two levels only.

Therefore it is respectfully submitted that neither of the documents cited by the Examiner teach or suggest the use of separately addressable sub-pixels wherein the area of a sub-pixel is not a multiple of the area of a smaller sub-pixel. The only teaching in both documents is that the larger area should be a multiple of the smaller area. Consequently, it is respectfully submitted that the present invention is not rendered obvious by either of these documents, alone or in combination. It is also noted that neither document teaches the use of sub-pixels having more than two transmission/reflection levels.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue. If it is determined that a telephone conference would expedite the prosecution of this application, the Examiner is invited to telephone the undersigned at the number given below.

In the event the U.S. Patent and Trademark Office determines that an extension and/or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to Deposit Account No. 03-1952 referencing docket no. 527122000300.

Dated: May 26, 2006

Respectfully submitted,

By

Alex Chartove
Registration No.: 31,942
MORRISON & FOERSTER LLP
1650 Tysons Blvd, Suite 300
McLean, Virginia 22102
(703) 760-7744

Attachments

REPLACEMENT SHEETS